CD-ROMs, CD-Rs, CD+Rs, CD-RWs, CD+RWs, DVD-ROMs, DVD-Rs, DVD+Rs, DVD-RWs, DVD+RWs, DVD-RAMs, BD-ROMs, BD-Rs, BD-R LTHs, BD-REs, magnetic tapes, floppy disks, magneto-optical data storage devices, optical data storage devices, hard disks, solid-state disks, and any device known to one of ordinary skill in the art that is capable of storing the instructions or software and any associated data, data files, and data structures in a non-transitory manner and providing the instructions or software and any associated data, data files, and data structures to a processor or computer so that the processor or computer can execute the instructions. In one example, the instructions or software and any associated data, data files, and data structures are distributed over network-coupled computer systems so that the instructions and software and any associated data, data files, and data structures are stored, accessed, and executed in a distributed fashion by the processor or computer.

[0086] While this disclosure includes specific examples, it will be apparent to one of ordinary skill in the art that various changes in form and details may be made in these examples without departing from the spirit and scope of the claims and their equivalents. The examples described herein are to be considered in a descriptive sense only, and not for purposes of limitation. Descriptions of features or aspects in each example are to be considered as being applicable to similar features or aspects in other examples. Suitable results may be achieved if the described techniques are performed in a different order, and/or if components in a described system, architecture, device, or circuit are combined in a different manner, and/or replaced or supplemented by other components or their equivalents. Therefore, the scope of the disclosure is defined not by the detailed description, but by the claims and their equivalents, and all variations within the scope of the claims and their equivalents are to be construed as being included in the disclosure.

What is claimed is:

1. A three-dimensional (3D) rendering method, comprising:

determining a vertex for a first shading from among vertices of a 3D model based on characteristic information of the 3D model;

performing the first shading on the determined vertex;

determining a pixel area for a second shading based on reference information;

performing the second shading on the determined pixel area; and

generating a rendered image based on the first shading and the second shading.

2. The method of claim **1**, wherein the determining of the vertex for the first shading comprises determining the vertex based on a length of an edge between a vertex and a neighboring vertex of the 3D model.

3. The method of claim **1**, wherein the determining of the vertex for the first shading comprises:

determining the vertex based on an area of a polygon formed with the vertex.

4. The method of claim **1**, further comprising:

dividing a surface of the 3D model into a plurality of areas in response to a determination of an applicability of a surface subdivision to the 3D model, and the determining of the vertex for the first shading comprises determining the vertex based on the divided the 3D model.

5. The method of claim **4**, wherein the dividing of the surface of the 3D model comprises adding at least one vertex to the surface of the 3D model.

6. The method of claim **1**, wherein the reference information indicates whether the first shading is applied to at least one vertex comprising the pixel area.

7. The method of claim **6**, wherein the determining of the pixel area for the second shading comprises determining the pixel area based on the reference information and a threshold value.

8. The method of claim **1**, wherein the determining of the vertex comprises:

determining the vertex to which the first shading is to be applied based on at least one of information about a vertex density of the 3D model, information about an area of a polygon formed by vertices of the 3D model, information about a distance among vertices to be projected to a screen space, information about an area of a polygon to be projected to the screen space, or information about a distance between a vertex and a virtual light source.

9. The method of claim **1**, wherein the characteristic information of the 3D model is determined based on at least one of vertex information of the 3D model, location information of a virtual camera, direction information of the virtual camera, location information of a virtual light source, or direction information of the virtual light source.

10. The method of claim **1**, wherein the first shading is determined in a vertex unit of the 3D model, and the second shading is determined in a pixel unit of an image frame in which the 3D model is expressed.

11. The method of claim **1**, wherein the determining of the pixel area for the second shading comprises determining the pixel area based on a speed at which rendering is performed on the 3D model and the reference information.

12. A computer program embodied on a non-transitory computer readable medium, the computer program being configured to control a processor to perform the method of claim **1**.

13. A three-dimensional (3D) rendering apparatus, comprising:

a determiner configured to determine a vertex for a first shading from among vertices of a 3D model based on characteristic information of the 3D model;

a first shader configured to perform the first shading on the determined vertex;

a second shader configured to determine a pixel area to apply a second shading based on reference information, and to perform the second shading on the determined pixel area; and

a rendered image generator configured to generate a rendered image based on the first shading and the second shading.

14. The apparatus of claim **13**, wherein the first shader is further configured to allocate, to each vertex of the 3D model to be projected to a screen space, a vertex attribute value indicating whether the first shading is performed.

15. The apparatus of claim **13**, wherein the determiner comprises:

a divider configured to determine whether a surface subdivision is applicable to the 3D model, and to divide a surface of the 3D model into a plurality of areas in response to the applicability of the surface subdivision.